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Wells and Pumping Systems for Domestic Water Supplies

by JAMES P. GIBB

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CONTENTS

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WELLS AND PUMPING SYSTEMS FOR DOMESTIC WATER SUPPLIES

by James P. Gibb

Introduction

This circular presents basic information on wells and pumping systems used for farm and domestic groundwater supplies. It describes types of wells and their construction, development, and costs. It discusses the various types of pumps and pressure tanks, how to select them, and their costs. Suggestions on locating wells to prevent pollution and procedures for disinfecting a home water supply system are included.

Each year the Illinois State Water Survey receives numerous requests from individuals for advice on locating, developing, or treating home or farm water supplies. This report on wells and pumps is one of three circulars designed to provide commonly needed information. Circular 116 tells step-by-step how to plan a domestic water supply and discusses briefly how groundwater occurs and where it is available in the state. Circular 118 deals with water quality and treatment for small water supplies.

Answers to specific problems not covered in these publications may be obtained by contacting the State Water Survey at Urbana (see appendix A for address and instructions).

This study is part of a continuing program of water-resource investigations being conducted by the Illinois State Water Survey under the general direction of Dr. William C. Ackermann, Chief, and John B. Stall, Head of the Hydrology Section. The report was prepared under the direct guidance of William H. Walker.

Locating Wells

Wells must be properly located to avoid pollution. To prevent bacterial pollution, the commonly accepted criteria require that the top of the well casing be a minimum of 8 inches above ground level to prevent the entrance of polluted surface water.

These criteria also specify the foliowing minimum spacings: 50 feet between wells and tile sewers, barnyards, and septic tanks; 100 feet between wells and leaching pits; and 150 feet between wells and cesspools. Where the soils near the surface are primarily silt or sand, doubling these lateral distances is recommended.

Forcing groundwater to flow through such lateral distances of earth material is considered adequate to filter out harmful bacteria, but it generally is not adequate to remove chemical pollutants in the water. Chemical pollutants might be nitrates, chlorides, or petroleum products. Chemical pollutants from such sources as garbage dumps, barnyards, septic tanks, farm fields, and gas storage facilities have been known to travel several hundred feet through aquifers and into wells. For this reason, if chemical pollutants are known to exist, it is especially important to locate the well *as far away* and *up-slope* from potential pollution sources as is economically and physically practical.

If chemical pollution appears to be a problem or there is uncertainty about a location from the standpoint of possible bacterial pollution sources, the State Department of Public Health should be consulted (see appendix B for addresses).

In addition to locating a well away from possible sources of pollution, it also should be situated so that it is accessible for maintenance, repair, and inspection. For example, wells should not be located in basements nor directly under trees or power lines.

Types of Wells and Construction Features

Drilled Wells

Drilled and bored wells are the two most common types used for farm and domestic water supplies in Illinois. Drilled wells, 4 to 6 inches in diameter, normally are constructed in parts of the state underlain by permeable deposits of sand and gravel or bedrock formations that are capable of yielding water to a well as fast as it is withdrawn. Some county health departments require a minimum well diameter of 6 inches.

Sand and gravel drilled wells (figure 1) range in depth from about 30 to 100 feet in most of southern and western Illinois and in isolated areas of northeastern Illinois. In the east-central portion of the state and other areas underlain by preglacial buried valley systems, the sand and gravel wells may range in depth from about 200 to over 300 feet.

Bedrock wells (figure 2) tapping permeable sections of sandstone or cracked and creviced limestone or dolomite formations range in depth from about 100 to 200 feet in south-central Illinois and parts of northeastern and northwestern Illinois. Along the western edge of the state and in most of northern Illinois, wells range in depth from 300 to over 600 feet.

Drilled wells may be constructed by the cable-tool or rotary methods. In the cable-tool method, the earth materials are broken into small fragments by the alternate raising and dropping of a heavy chisel-edged bit, and these fragments are removed from the hole by a bailer. In unconsolidated formations, an open hole is maintained by driving a stringer of casing as drilling progresses. After the aquifer has been penetrated, a well screen usually is placed opposite the water-bearing formation, the casing pulled upward to expose the screen, and the screen sealed to the casing.

There are three rotary drilling methods commonly used in Illinois. These are: conventional hydraulic, reverse hydraulic, and air rotary.

In the conventional hydraulic and air rotary methods, the earth materials are broken into small particles by a rotating bit and brought to the surface by a thick drilling fluid or high velocity air pumped down through the drill pipe and back up the bore hole. In the reverse hydraulic method, the drill cuttings are withdrawn through the drill stem with fairly clean water constantly being added to the bore hole.

Construction features of drilled wells are illustrated in figure 3. As shown in figure 3a, drilled sand and gravel wells normally consist of a steel casing extending from slightly above land surface to the top of the water-bearing sand followed by a commercially made screen designed to hold back the sand yet permit free entry of water into the well.

Torch-cut and hand-sawed slotted casing sometimes is substituted for commercially made well screens because of the cheaper initial cost; this practice is not recommended because the openings in such a casing are usually too large to retain the aquifer material and too few to allow free flow of water into the well. Most wells so equipped have a history of silt or sand pumping, low yield, and short production life. Thus they often prove to be more costly on a long-term basis than the well equipped with a commercially made screen. Wells finished in bedrock aquifers not subject to caving do not require well screens.

Drilled bedrock wells normally consist of a steel casing fitted with a drive shoe and extending from above land surface through the unconsolidated glacial materials and any sections of rock that will cave, followed by an open bore hole opposite the water-bearing unit (see figure 3b).

For both sand and gravel and bedrock wells, the annulus between the bore hole and casing is sealed from surface pollution by a pitless adapter unit at the surface and cement or clay slurry grout to minimum depths of 20 to 40 feet.

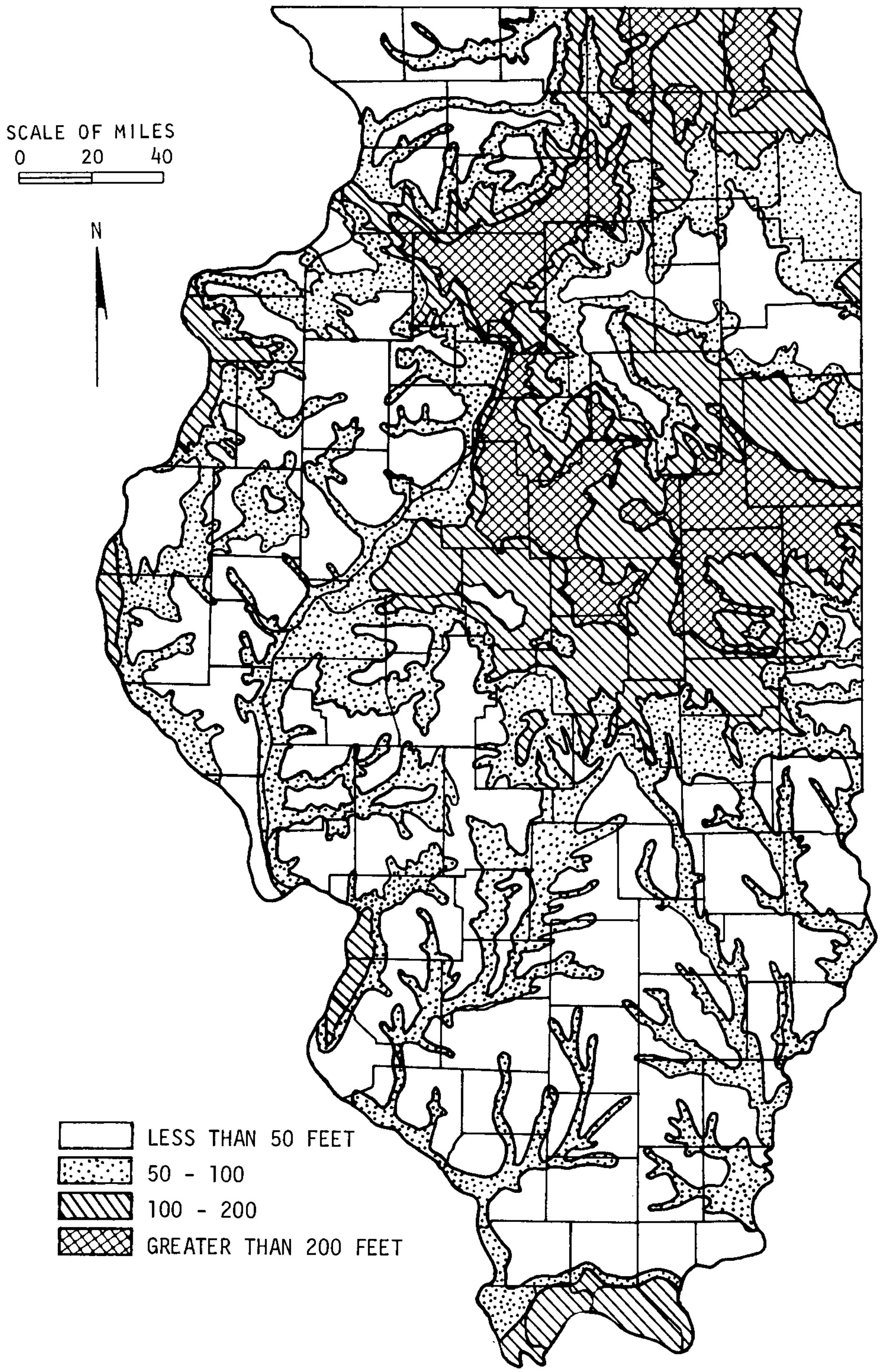

Figure 1. Probable maximum depth of domestic sand and gravel wells

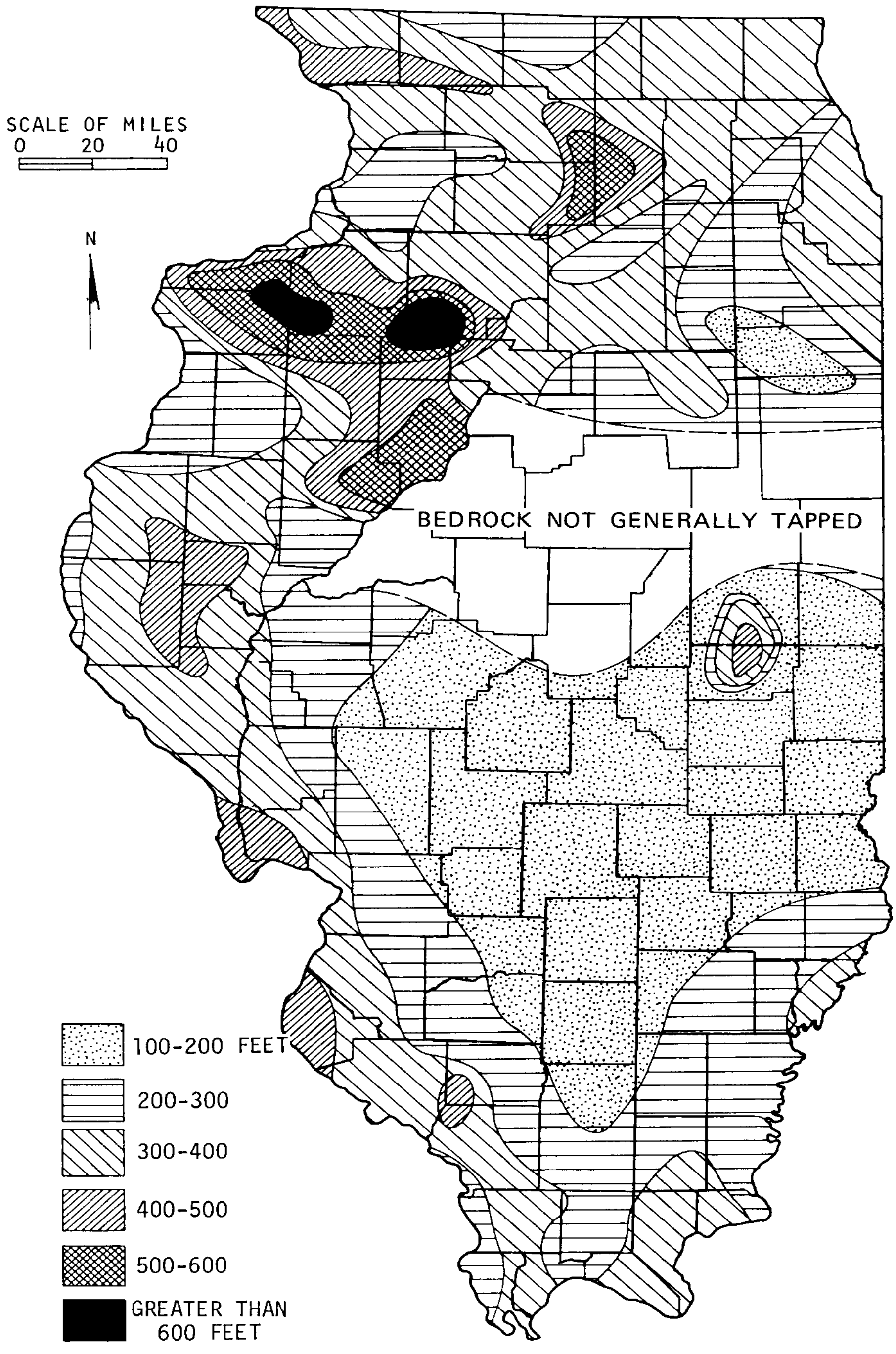

Figure 2. Probable maximum depth of domestic bedrock wells

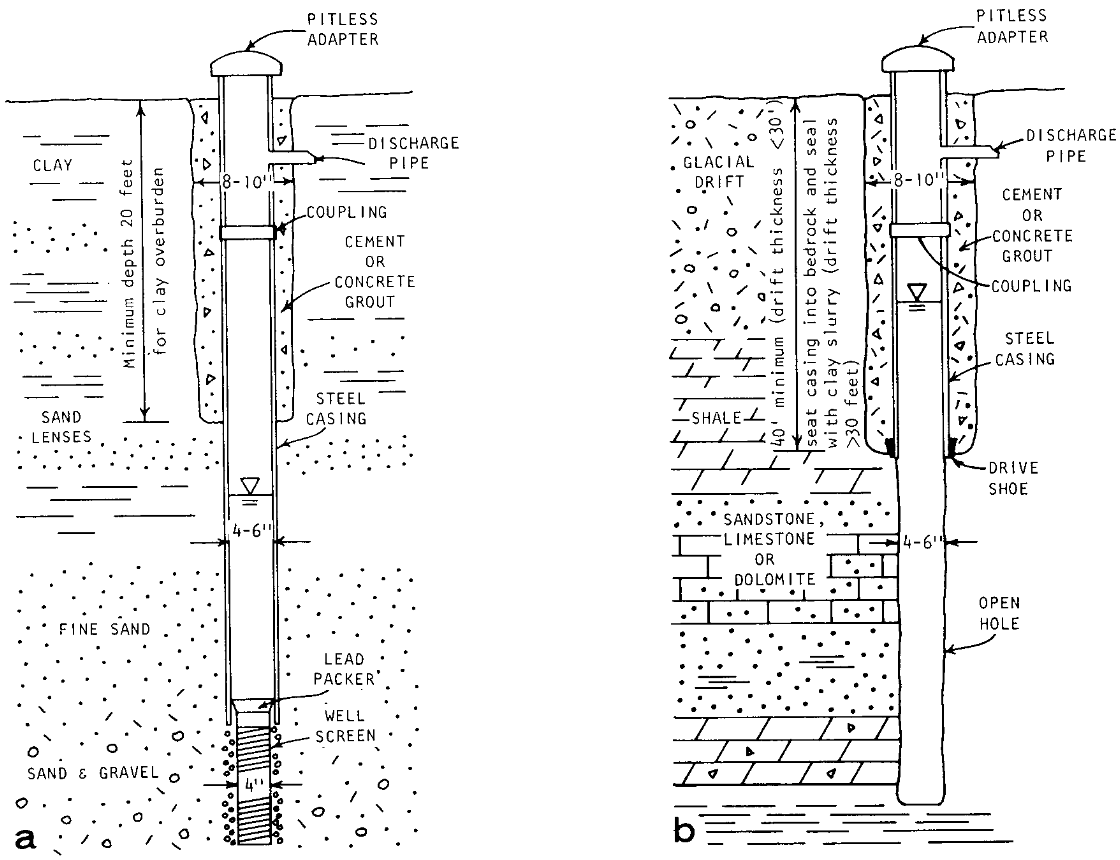

Figure 3. Typical domestic sand and gravel well (a) and bedrock well (b)

Bored Wells

Bored wells, commonly 36 inches in diameter, usually are required where the water-bearing materials are thin and relatively impermeable. In such aquifers the large-diameter bored wells provide several hundred gallons of water in storage for use during heavy pumping periods. Also, water withdrawn is slowly replenished by seepage from the surrounding fine-grained materials during times of little or no pumpage.

Large-diameter bored wells now being constructed generally range in depth from about 30 to 50 feet. This type of well is most common in those parts of western and southern Illinois where the glacial drift deposits are thin and relatively fine grained (see open areas in figure 1).

Current methods for constructing large-diameter wells involve the use of a rotary bucket drilling rig for the excavating process. A large cylindrical bucket with auger type cutting blades on the bottom is rotated until the bucket is loaded with the materials being excavated. When full, the bucket is raised and swung aside to be dumped. Sections of precast large-diameter concrete tile are then placed to case the hole. This type of operation has proven most successful in areas where clay formations are present and caving of overlying materials into the bore hole is at a minimum.

Construction features of bored wells are shown in figure 4. Sections of precast concrete pipe (36-inch inside diameter, 42-inch outside) normally are used as the casing

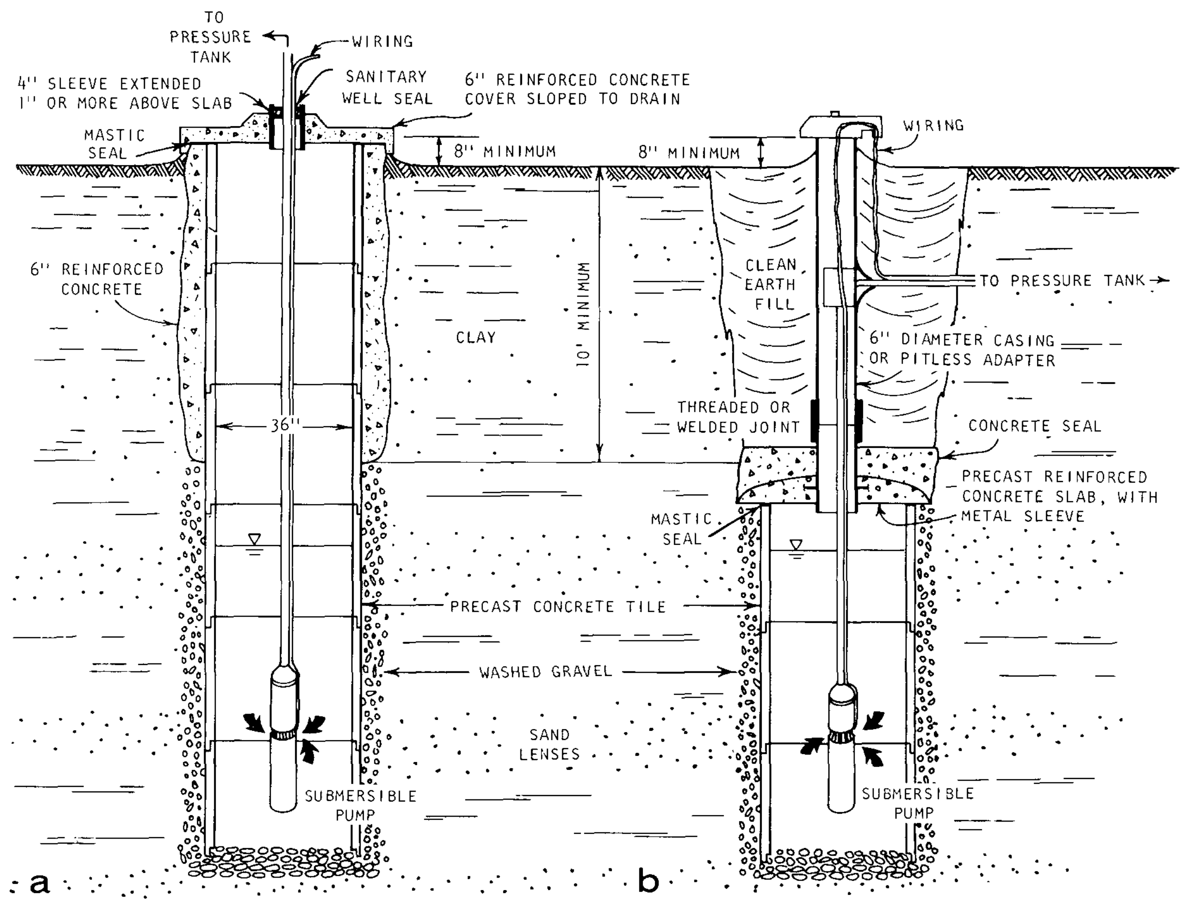

Figure 4. Recommended construction features of large-diameter bored wells

material from slightly above land surface to the bottom of the well. In some bored wells the lower part of the concrete casing opposite the aquifer material is perforated to allow easier access of water to the well.

Many bored wells are protected from surface pollution by a 6-inch thickness of reinforced concrete poured around the outer part of the casing and the upper 10 feet of bore hole (figure 4a). Below the 10-foot depth, this annular space usually is filled with clean sand or pea gravel.

In this type of construction, a solid concrete slab at least 6 inches thick, adequately reinforced, and having a diameter large enough to overlap the poured concrete by 2 inches usually is installed as a well cover. The top of the slab should be sloped to drain and should have a watertight joint made with mastic where the slab rests on the concrete. An adequately sized pipe sleeve or sleeves should be cast in the slab to accommodate the type of pump proposed for the well.

In another approved method of sealing bored wells from surface pollution, the concrete casing is stopped at a depth of 10 feet below land surface as shown in figure 4b.

Then a buried slab of reinforced concrete, with a 6-inch pipe cast in it, is installed on the well casing at the 10-foot depth. A 6-inch casing or a full length pitless adapter is fastened to the pipe in the slab and is extended to a level at least 8 inches above finished ground level. The opening between the steel pipe or pitless unit and the upper 10 feet of bore hole is filled with clean, fine-grained earth materials and thoroughly tamped to minimize settling and the infiltration of pollutants from the surface. Below the 10-foot depth, the annulus between the large-diameter concrete casing and bore hole is filled with clean sand or pea gravel.

Developing and Testing Wells

After the actual drilling of a well has been completed and the casing and screen (if applicable) have been installed, development work should be undertaken by the driller to properly complete the well and the well should be tested for yield.

The basic principle of developing wells is to loosen and remove the drilling mud, silt, and other fine materials from an area immediately around the well bore or screen. This creates larger passages in the water-bearing formation through which the water can flow toward the well. In addition it should eliminate any clogging or compacting of the water-bearing formation that may have occurred during drilling. Proper development of any well should result in the ability to pump clear sand-free water at the desired pumping rate.

A well is developed by creating alternating flow of water into and out of the well. Common techniques for drilled wells include bailing, surging with air or a mechanical device, intermittent pumping or rawhiding, or some combination of these. In the case of large-diameter bored wells little development work normally is possible. However, repeated pumping and allowing the well to recover often increases the rate of recovery and yield potential.

After development work is completed, the well should be test-pumped by the driller to prove the adequacy of the installation for its intended use. The purpose of this test is to measure the well's water yielding capability in terms of its drawdown. Such a test is needed to determine if the well will yield the quantity of water desired and to choose the proper size pump, the depth it should be set, and the size of pressure tank needed.

Here is an example of testing a drilled well. We will assume that a 75-foot deep drilled sand and gravel well equipped with 5 feet of screen between depths of 70 and 75 feet had a static water level about 15 feet 5 inches below land surface. When first completed the driller pumped the well at 5 gallons per minute (gpm) for 2 hours at which time the water level was about 40 feet 2 inches below land surface. From the results of this test, two general conclusions can be made:

1) During the 2-hour test period 600 gallons of water was pumped and the water level was still well above the top of the screen. This indicates that the well is capable of producing at least 600 gallons per day, more than most domestic daily needs.
2) Since the water level at the end of the test was still above the screen, the use of a 5-gpm pump with the intake located just above the screen (say at 65 feet) seems to be a reasonable choice. Common practice suggests that a 42-gallon pressure tank would be used with a 5-gpm pump.

In the case of large-diameter bored wells, measuring the recovery rate after the well has been pumped dry gives the best indication of the well's yield. The large volume of water stored in the well must be removed before the formations penetrated fully begin yielding water.

Here is an example of a test for a large-diameter bored well. We will assume that a 36-inch diameter well, 40 feet deep, had a static water level about 12 feet below land surface. The well was pumped until the water level was lowered to 35 feet 3 inches and then allowed to recover (pumping was stopped).

Six hours after pumping stopped, the water level had risen to a depth of 21 feet 3 inches. This means the well had 14 feet of recovery (35 feet 3 inches — 21 feet 3 inches = 14 feet).

Since a 36-inch well has a volume of about 53 gallons of water for each foot of water depth, about 742 gallons of water (14 feet × 53 gallons per foot) entered the well in the 6-hour recovery period. From this test we can conclude that:

1) The well is capable of producing more than normal domestic daily needs in a 6-hour period (742 gallons produced in contrast to normal daily needs of 200 gallons for a family of 4).
2) To maximize available water the pump intake should be within 5 feet of the well bottom. If 200 gallons per day is needed, a 5-gpm pump and a 42-gallon pressure tank should be adequate. Also, 200 gallons of water pumped from the well all at once would lower the water level only about 4 feet (200 gallons ÷ 53 gallons per foot).

Well Costs

The costs of farm and domestic wells have been studied by the State Water Survey and are discussed in detail in our Circular 104. Costs presented in that circular were considered valid in 1969 but will need to be increased as time passes.

In Circular 104 it was determined that in 1969 a 4-inch diameter sand and gravel well usually cost about $4.50 per foot plus an additional $150 for a 3- or 4-foot section of screen. Costs in 1978 are running about $10.00 per foot plus $200 for a 3- or 4-foot section of screen. On the basis of these cost figures and the well depths shown in figure 1, costs may vary from about $700 (a 50-foot deep well) to $3700 (a 350-foot deep well).

The original cost studies on drilled bedrock wells suggest that, in 1969, 4-inch wells of this type cost about $3.50 per foot, 5-inch wells about $4.65 per foot, and 6-inch wells about $4.70 per foot. In some portions of Illinois it is occasionally necessary to install an 8-inch casing from the ground surface to the top of the consolidated bedrock, and then install a smaller casing (usually 6- or 4-inch) into the bedrock to seal out formations subject to caving. Wells of this type then cost about $6.25 per foot.

Reported costs in 1978 for 4-inch, 5-inch, and 6-inch wells are about $10.00, $11.00, and $13.00 per foot, respectively. On the basis of the 1978 costs for 4- and 6-inch bedrock wells and the well depths shown in figure 2, costs may vary from about $500 to $650 (4- and 6-inch wells 50 feet deep) to about $5000 to $6500 (4- and 6-inch wells 500 feet deep).

The costs of modern concrete cased large-diameter wells also were presented in Circular 104. That study suggested that 36-inch inside diameter wells of this type cost about $11.50 per foot in 1969. Reported costs in 1978 are about $24.00 per foot plus $200 for finishing the well top. It is estimated from the 1978 cost; that these wells range from about $800 (a 25-foot deep well) to $2000 (a 75-foot deep well.

These costs cover constructing, developing, and testing the wells, but do not include pumps and other related installations.

Types of Pumps and Their Selection

There are four basic types of pumps commonly installed in farm and domestic wells in Illinois. These are: 1) submersible, 2) jet, 3) centrifugal, and 4) piston. In most cases, the type of pump selected for a particular installation depends on the personal preference of the well owner or pump installer. However, in a few instances the physical limitations of the well may restrict the type of pump that can be considered.

Regardless of which type of pump is selected, it should be capable of delivering the required daily demands at adequate pressures. However, the pump capacity should not be greater than the yield capability of the well.

The average water needs for a typical family of 4 is about 200 gallons per day (50 gallons per day per person). This amount of water can be pumped in 3 hours and 20 minutes each day with a 1-gpm pump, in about 40 minutes wirh a 5gpm pump, and in only about 20 minutes with a 10-gpm pump.

The following general factors should be considered in selecting a pump for maximum performance and service life.

1) The pump selected should be capable of producing water at the desired rate and 'total head' while operating near its peak efficiency. The 'total head' includes the vertical distance from the probable pumping water level to the highest point in the distribution system, anticipated friction losses in the piping, and the desired minimum pressure at the highest outlet or faucet.
2) Water quality should be considered, particularly if methane gas, iron bacteria, or sand pumping is a problem.
3) The initial cost, operating expense, and expected maintenance costs should be considered.

In addition, the pump should be capable of producing at the desired rate without lowering the water below the top of the screen in a sand and gravel well or below the midpoint of the principal water-bearing unit of a bedrock well. Pumps installed in large-diameter wells should be set very close to the bottom of the well to fully utilize the available water storage in this type of well. To satisfy some of the above considerations, a smaller capacity pump than originally desired may be necessary.

Following is a brief discussion of each type of pump, including its advantages and its disadvantages.

Submersible

The submersible pump is one of the most recent developments in the water well pump industry and has been widely accepted by well owners and drilling contractors in Illinois. It is estimated that more than 90 percent of new well pump installations in the state are of this type.

Submersible pumps can deliver water from any depth at a wide range of capacities, may be installed in wells 3 inches or more in diameter, require no well house or frost proofing, and have proven to be a very dependable type of pump. Special care should be taken to insure that submersible pumps are protected from possible lightning damage.

A typical submersible pump installation is shown in figure 5.

The submersible pump has an electric motor and pump assembly that are suspended in the well below the pumping water level on the pump discharge pipe. It has a special water-proof electrical cable. The intake for the pump assembly is located directly below the pump section and above the electric motor. Multistage centrifugal type submersibles are most commonly installed in farm and domestic wells in Illinois. However, in recent years, a helical-rotar type has proved to be especially useful in wells that produce excessive methane gas or sand with the water.

In 1978, the consumer purchase price for domestic size submersible pumps (not installed) was from about $255 to $1230, depending on the size, pumping rate, and total lifting capability. For example, a 1/3 horsepower, 4-inch diameter pump rated at 5 gpm at 190 feet total head cost $325.

Jet

Jet pumps have been in use for some 30 years or more and still are considered to be a very satisfactory pump for modern day uses. However, because of the current popularity of the submersible pump, it is estimated that only about 5 percent of the new well pump installations in Illinois are jet types.

Jet pumps have relatively few moving parts and can be offset from the well for easy maintenance. Jet pumps are particularly susceptible to damage when pumping water containing sand or silt. They also must be operated very close to the manufacturer's specifications or their efficiencies may be comparatively low.

Shallow well jet (one-pipe) and deep well jet (two-pipe) pumps both are commonly used in Illinois.

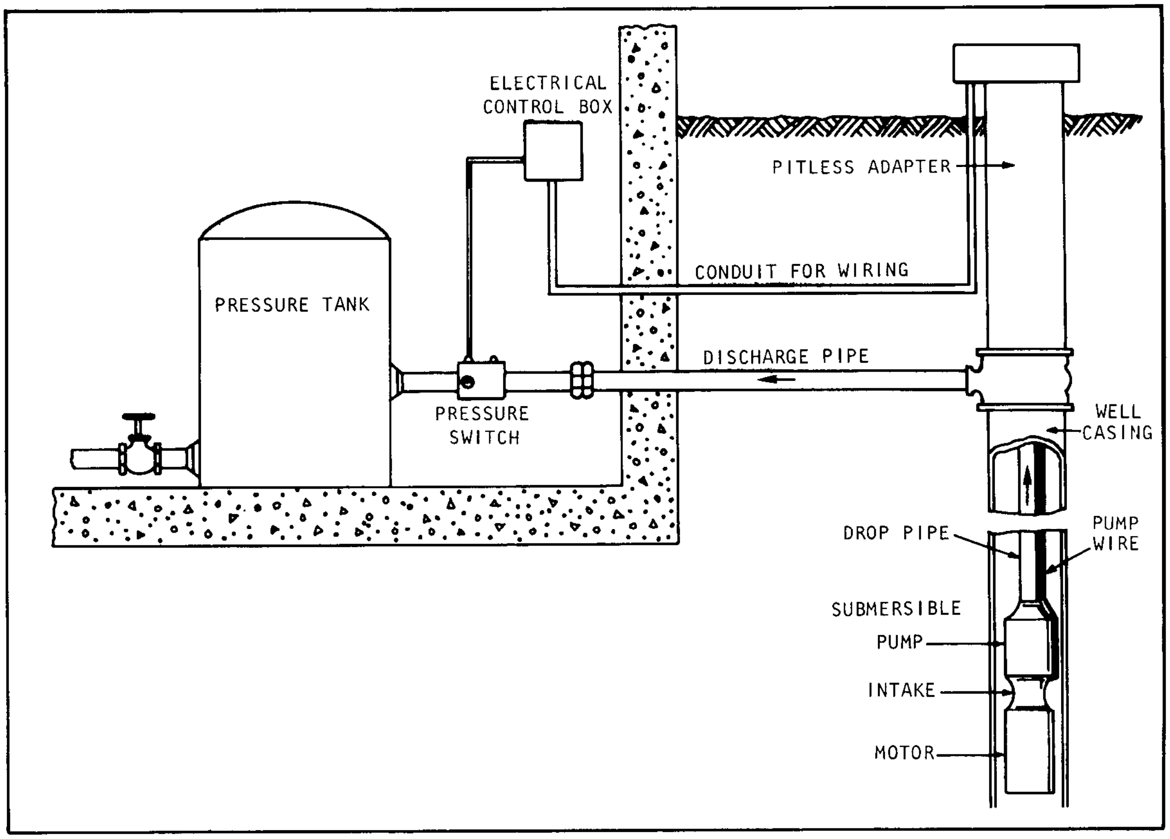

Figure 5. Typical installation for a submersible pump

The shallow well jet can be installed in 1¼-inch or larger diameter wells but is limited to pumping water from depths less than 15 or 20 feet. The jet assembly for this type of application is installed in or attached just outside the pump case, and one suction pipe goes down into the well.

The deep well jet can be installed in wells 2 inches or more in diameter and are most efficient when pumping water from depths between about 15 and 100 feet. Two pipes, a pressure pipe and a suction pipe, come from the pump and are routed into the well below the pumping level where the jet assembly is installed.

Typical shallow and deep well jet pump installations are shown in figures 6 and 7, respectively.

The jet pumping unit consists of a centrifugal type pump and a jet or ejector assembly. The centrifugal pump forces water to the jet assembly where it passes through a high velocity nozzle and into a venturi tube. The high velocity water passing through the venturi tube creates a partial vacuum and additional water is sucked into the venturi section and returned through the suction pipe to the pump. Part of this water is again circulated to the jet unit and the remainder is ejected to the distribution system.

In 1978, the consumer purchase price for shallow well and deep well jet pumps (not installed) was from about $145 to $325 and $155 to $360, respectively. For example, a ½ horsepower shallow well jet rated at 5 gpm at 150 feet total head cost $225 and a 1 horsepower deep well jet rated at 5 gpm at 185 feet total head cost $300.

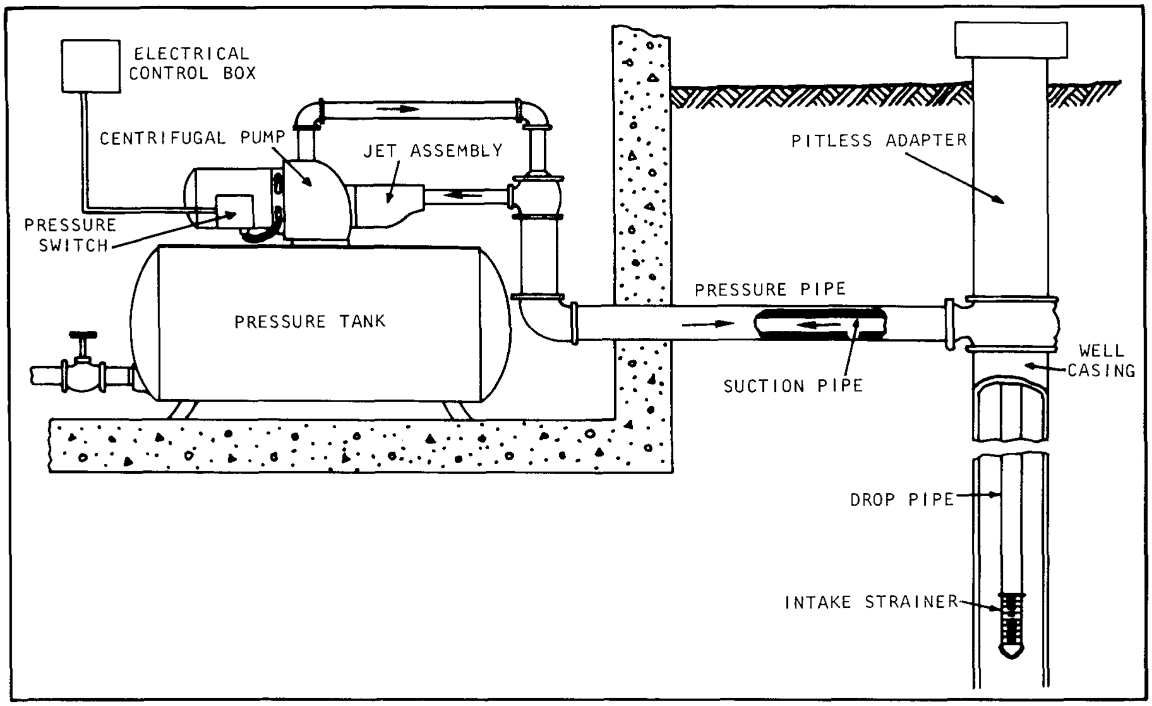

Figure 6. Typical installation for a shallow well jet pump

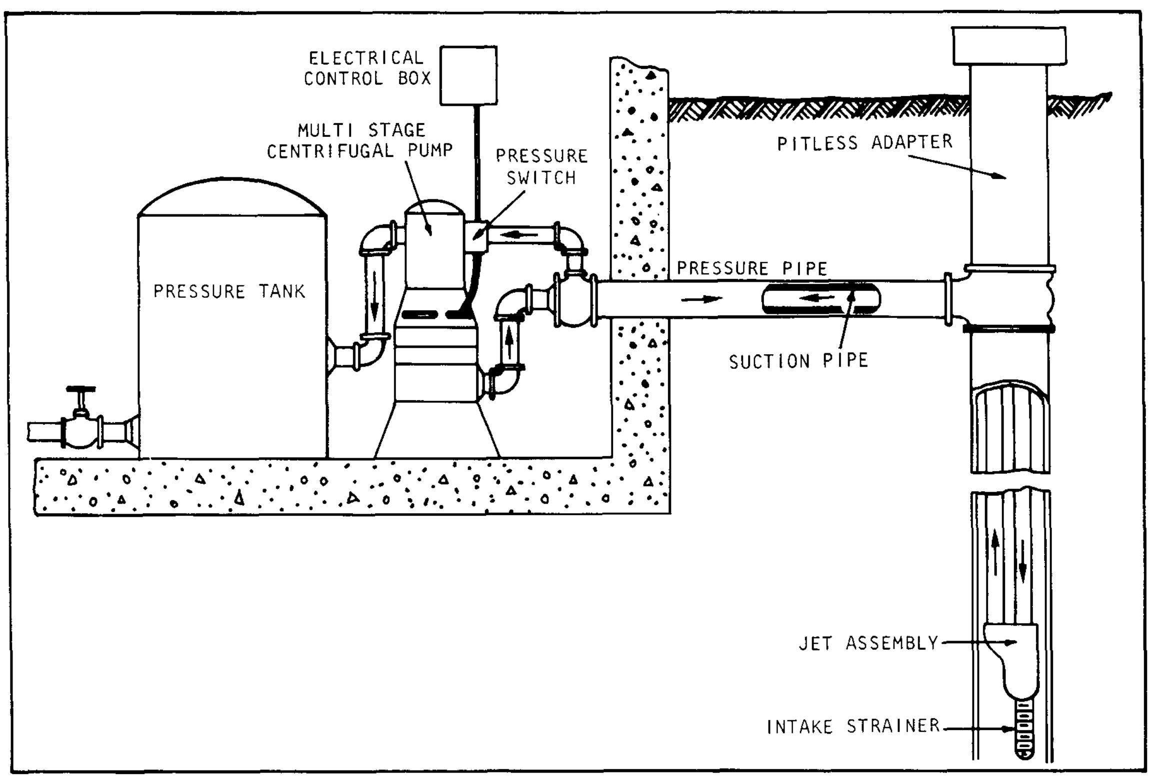

Figure 7. Typical installation for a deep well jet pump

Centrifugal

The centrifugal pump is one of the simplest types used for pumping water from shallow depths (less than 10 or 15 feet). Traditionally these pumps have been used on the old large-diameter brick-lined dug wells. However, it is estimated that less than 5 percent of the new well pump installations in the state are of this type.

Centrifugal pumps are reliable and have a long service life. They are almost always off-set from the well and accessible for maintenance. Problems often involved in the use of centrifugal pumps are the easy loss of prime and low efficiencies if not operated very close to the manufacturer's design recommendations.

The centrifugal pump operates on a suction principle and is therefore limited to shallow pumping lifts (10 to 15 feet). They can be used in wells with diameters greater than 1¼ inches and are most commonly used on shallow large-diameter wells and cisterns.

A typical centrifugal pump installation would be very similar to the shallow well jet installation shown in figure 6.

In 1978, the consumer purchase price for centrifugal pumps (not installed) was from about $140 to $350. For example, a ½ horsepower centrifugal pump rated at 14 gpm at 50 feet total head cost $180.

Piston

The piston pump is one of the oldest types of pumps still used in Illinois. However, because of the noise and vibration of these pumps compared with newer types, only a few new piston pump installations are made in the state each year.

Piston type pumps can be used on 1¼-inch or greater diameter wells. They can pump water containing very small amounts of sand with little resulting damage and are adaptable to hand operation in case of a power failure.

Piston pumps are restricted in capacity by the limited strength of the materials (pump rods for example) used in their operation. They also create a pulsating discharge which may cause some vibration and noise throughout the distribution system.

The piston pump operates on a suction and positive displacement principle. The location of the piston assembly depends on the type of well application. Shallow well piston pumps have the piston at land surface or in a basement or pit and can pump water from depths up to 15 or 20 feet below the pump level. For greater pumping lifts a deep well piston pump, often called a working head or rod pump, is used. In this case the piston assembly is located in the well several feet below normal pumping water levels.

A typical deep well piston pump installation is shown in figure 8.

In 1978, the consumer purchase price for piston type pumps (not installed) was from about $325 to $525.

Pressure Tanks

Most farm or domestic water supply systems are equipped with a pressure tank to provide a small amount of stored water and to maintain a suitable range of operating pressures.

Two basic types of pressure tanks commonly are used in Illinois.

In one type, an elastic membrane inside the tank is precharged on one side with a specific amount of air, usually 30 pounds per square inch (psi). Water is then pumped into the tank against the membrane to a predetermined maximum pressure.

In the other type, water is pumped into the tank until the air inside is compressed to a predetermined maximum pressure. Both types of tanks use a pressure control switch to start the pump at a minimum desired operating pressure (usually 30 to 40 psi) and to stop the pump at the maximum desired operating pressure (usually 50 to 60 psi).

In tanks where the air and water are in

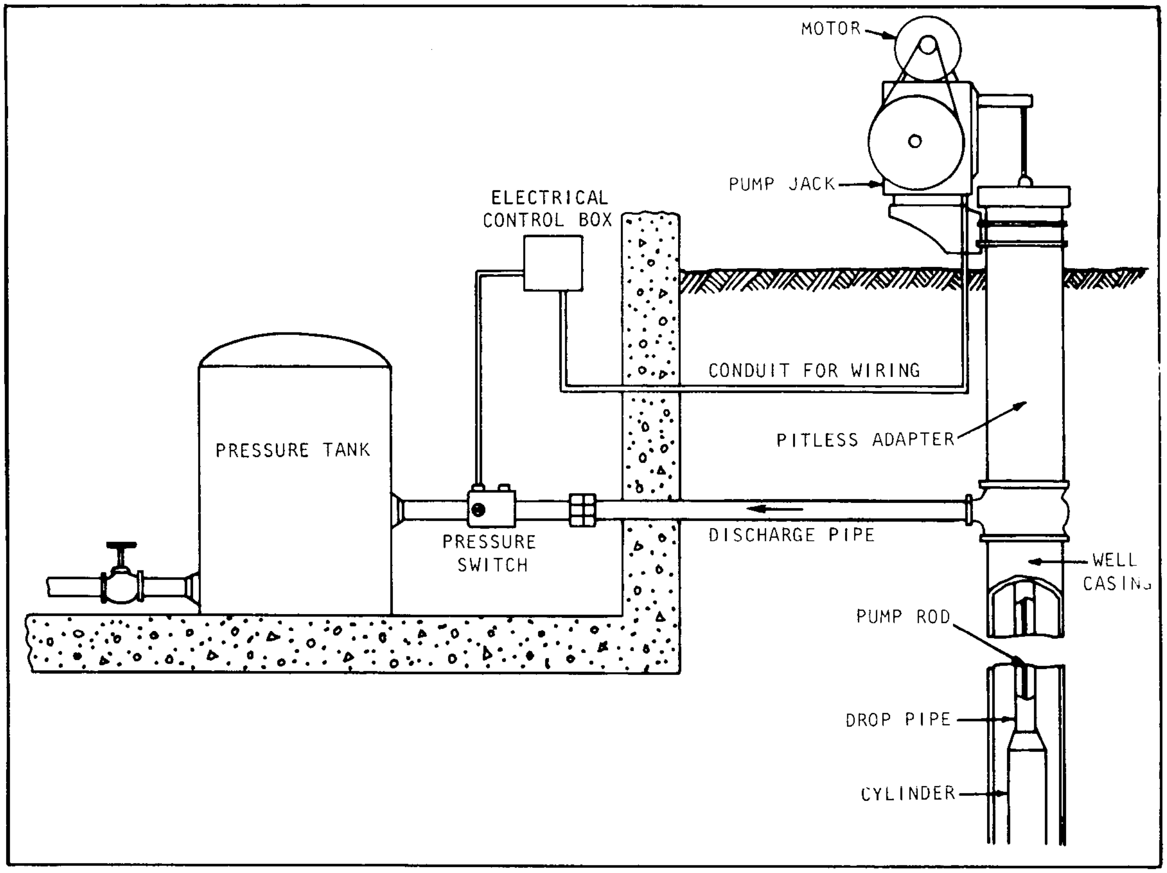

Figure 8. Typical installation for a deep well piston pump

direct contact, some of the air may be absorbed and removed with the water causing the pressure tank to become 'waterlogged.' This usually occurs in systems equipped with shallow well centrifugal, jet, or piston pumps. On the other hand, deep well piston and submersible pumps usually add air as they pump and may cause the tank to become 'air-bound.'

'Waterlogged' tanks cause pumps to run almost continuously, while an 'air-bound' tank causes the pump to turn on and off too often. For these reasons, special air replacement or air release devices are installed on the air-water contact type of tank. These problems are minimized in the precharged membrane type of tank, and air control devices usually are not necessary.

The size or pressure tank volume needed for a farm or domestic supply system depends on the well yield, pump capacity, water requirements, and desired operating pressures. In selecting the size and type of tank to use, the specifications of the manufacturers and recommendation of the pumping system installer should be considered heavily.

It should be noted that most pressure tanks allow only about 10 percent of their total for usable storage (that which can be withdrawn between the maximum and minimum pressures). Precharged membrane type tanks usually provide 1 or 2 times more usable storage than the air-water contact type. For common tank sizes of 42, 82, and 220 gallons, the usable water storages would be:

		(gallons)	
Tank size	42	82	220
Usable storage			
Precharged	13	25	68
Air-water	6	13	34

For most farm and domestic water supply systems a 42-gallon tank and 5-gpm pump or a 82-gallon tank and a 10-gpm pump should be adequate. However, for very low yielding wells and pumps (1 to 2 gpm), a 220-gallon tank may be necessary to assure a continuous supply during heavy water-demand periods of each day.

In 1978, the consumer purchase price (not installed) of standard precharged tanks was about $90 to $110 for 42-gallon tanks, $125 to $155 for 82-gallon tanks, and $250 to $550 for 220-gallon tanks. Air-water contact tanks ranged from about $100 to $120 for 42-gallon tanks, $160 to $175 for 82-gallon tanks, and $300 to $500 for 220-gallon tanks.

Pumping System Costs

The total installed costs of pumps and pumping system equipment (pitless adapter, pressure tank, electrical controls, plumbing, and wiring) are extremely variable depending on the types and sizes of the pump and pressure tank and the plumbing required to deliver water from the well to the tap. However, recent studies indicate that most farm or domestic groundwater supply pumping systems installed in Illinois cost from about $900 to $1500.

For any specific installation, detailed cost figures for various types and sizes of pumps, pressure tanks, and other equipment plus installation should be available from the pumping equipment suppliers or installing contractor.

Disinfection

New wells and their associated pumping systems, or old installations after rehabilitation, usually are bacterially contaminated and should be disinfected before being put into use. After the disinfection is completed, the well should be sealed to safeguard against future contamination. The Illinois Department of Public Health recommends disinfection procedures that are based on the use of a *strong chlorine laundry bleach* (5.25 percent chlorine). The correct amount to use can be determined from table 1, as explained in the instructions that follow.

Table 1. Recommended Chlorine Dosages for Well Disinfection

Diameter of well *(inches)*	Amount of chlorine *(cups)* for given depth of water in well *(feet)*					
	5	10	25	50	75	100
2	0.5	0.5	0.5	0.5	0.5	0.5
3	0.5	0.5	0.5	0.5	1.0	1.0
4	0.5	0.5	0.5	1.0	1.5	2.0
6	0.5	0.5	1.0	2.0	3.0	4.0
8	0.5	1.0	2.0	3.5	5.5	7.0
10	1.0	1.5	3.0	6.0	9.0	12.0
12	1.0	2.0	4.0	8.0	12.0	16.0
18	2.0	3.5	9.0	18.0	27.0	36.5
24	3.0	6.5	16.0	32.5	48.5	64.5
30	5.0	10.0	25.0	50.5	76.0	—
36	7.0	14.5	36.0	72.5	—	—
48	13.0	26.0	64.5	—	—	—
60	20.0	40.3	—	—	—	—

1) Measure the depth of water in the well if possible. (Considering the well full of water will be satisfactory in most cases since a slight overdose does no harm.)
2) Determine the amount of laundry bleach (from table 1) and mix it in about 10 gallons of water. For example, a 6-inch diameter well with 75 feet of water would require 3 cups of laundry bleach. If the well depth is not known, use ½ gallon bleach for a drilled well and 1 gallon for a bored well.
3) Pour this solution into the well between the casing and the drop pipe. (This will involve removing the cap from the pitless adapter unit.)
4) Connect one or more hoses from faucets on the discharge side of the pressure tank to the top of the well, and while pumping the well, let water from these flow back into the well for at least 15 minutes. Then open each faucet in the system and let the water run until a chlorine odor or taste is detected. Close all faucets. Seal the top of the well.
5) Let the well and system idle for several hours, preferably overnight.
6) Operate the pump, discharging water from all outlets until all chlorine odor and taste disappears. Faucets on fixtures discharging to septic tank systems should be throttled to a low flow, or temporarily diverted to an outside discharge point, to avoid overloading the disposal system.

Chlorine always should be used outdoors or in well-ventilated places, because breathing the fumes is dangerous. In heavy concentrations, chlorine also is harmful to the skin and clothing.

Additional instructions on safe water supplies from wells can be obtained from the Illinois Department of Public Health *(see appendix B for district offices and counties served).*

References

Anderson, Keith E. 1967. *Water well handbook.* Missouri Water Well & Pump Contractors Assn., Inc., Rolla, Missouri.

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Gibson, Ulrie P., and Rexford D. Singer. 1969. *Small wells manual.* Department of State, Agency for International Development, Washington, D. C.

Groundwater and wells. 1966. Edward E. Johnson, Inc., St. Paul, Minnesota.

Illinois Department of Public Health. 1970. *Water well construction code, rules and regulations.*

Private water systems. 1968. Midwest Plan Service, Iowa State University, Ames, Iowa.

Sanderson, E. W. 1971. *Groundwater availability in Piatt County.* Illinois State Water Survey Circular 107.

APPENDIX A — INFORMATION REQUESTS

Groundwater information requests should be accompanied by as much of the following data for each type of request as possible.

For a new supply

Information requests should be accompanied by the following data:

1) The legal location of the proposed well site to the nearest quarter of a quarter section, township, range, and county *(for example, NE¼ of the NE¼, Section 10, T 16 N, R 6 W, Sangamon County).*

2) Estimated daily water requirement *(in gallons)* **or explanation of planned use** *(for example, domestic supply for 4 persons, 10 head of cattle, and 100 head of swine).*

3) Information on existing wells located in the vicinity of the property *(depth, adequacy, quality of water, etc.).*

For existing well problems

Information requests should be accompanied by the following data:

1) A complete explanation of the problem including any recent changes in pumping equipment, water use, etc.

2) Complete information on the well(s) including:

a) Legal location of the well to the nearest quarter of a quarter section, township, range, and county.

b) Distances from potential sources of pollution *(septic tank, feedlots, privies, sewer lines, etc.).*

c) Type of well *(dug, bored, drilled, etc.).*

d) Depth of well *(in feet below land surface).*

e) Water levels *(in feet below land surface)* before and during pumping. Include the pumping rate *(in gallons per minute or gallons per hour).*

f) Capacity, make, and type of pump *(for example, 3 gallons per minute, Red Jacket deep well jet).*

g) Depth to bottom of pump intake.

h) Driller's log of well.

i) Casing length and diameter.

j) Screen length, diameter, and slot size.

For water quality information or problems

Information requests concerning the chemical quality of water should be accompanied by the following:

1) Complete information on the well as described above.

2) A one-quart water sample from the well.

a) The sample should be collected at a point in the system located on the well side of any pressure tank or water treatment equipment *(filter, softener, etc.).*

b) Collect the sample after the well has been pumped for about 10 or 15 minutes to insure that the water sample comes directly from the water-bearing formation and *not* from storage.

Information requests to the State Water Survey should be sent to:

Illinois State Water Survey
Water Resources Building
P. O. Box 232
Urbana, Illinois 61801

APPENDIX B – PUBLIC HEALTH OFFICES

Regional Offices

Addresses	*Counties Served*
Illinois Department of Public Health 4302 North Main Street Rockford, Illinois 61103 Phone 815-877-8051	**Carroll, De Kalb, Jo Daviess, Lee, Ogle, Stephenson, Whiteside, Winnebago**
Illinois Department of Public Health 5415 North University Avenue Peoria, Illinois 61614 Phone 309-691-2200	**Bureau, Fulton, Henderson, Henry, Knox, La Salle, Marshall, McDonough, Mercer, Peoria, Putnam, Rock Island, Stark, Tazewell, Warren, Woodford**
Illinois Department of Public Health Box 910 48 West Galena Boulevard Aurora, Illinois 60507 Phone 312-892-4272	**Boone, Du Page, Grundy, Kane, Kankakee, Kendall, Lake, McHenry, Will**
Illinois Department of Public Health 1919 West Taylor Room 809 Chicago, Illinois 60612 Phone 312-341-7290	**Cook**
Illinois Department of Public Health 4500 South Sixth Springfield, Illinois 62706 Phone 217-786-6882	**Adams, Brown, Calhoun, Cass, Christian, Greene, Hancock, Jersey, Logan, Macoupin, Mason, Menard, Montgomery, Morgan, Pike, Sangamon, Schuyler, Scott**
Illinois Department of Public Health 2125 South First Champaign, Illinois 61820 Phone 217-333-6914	**Champaign, Clark, Coles, Cumberland, De Witt, Douglas, Edgar, Ford, Iroquois, Livingston, McLean, Macon, Moultrie, Piatt, Shelby, Vermilion**
Illinois Department of Public Health 9500 Collinsville Road Collinsville, Illinois 62234 Phone 618-345-5141	**Bond, Clinton, Madison, Monroe, Randolph, St. Clair, Washington**
Illinois Department of Public Health 2209 West Main Street Marion, Illinois 62959 Phone 618-997-4371	**Alexander, Clay, Crawford, Edwards, Effingham, Fayette, Franklin, Gallatin, Hamilton, Hardin, Jackson, Jasper, Jefferson, Johnson, Lawrence, Marion, Massac, Perry, Pope, Pulaski, Richland, Saline, Union, Wabash, Wayne, White, Williamson**

Regional Laboratories

Illinois Department of Public Health
1800 West Fillmore
Chicago, Illinois 60612

Illinois Department of Public Health
P. O. Box 2467
Carbondale, Illinois 62901

Illinois Department of Public Health
134 North Ninth Street
Springfield, Illinois 62706